

# Measurements of Excitation Functions and Line Polarizations for Electron Impact Excitation of the $n = 2, 3$ States of Atomic Hydrogen in the Energy Range 11--2000 eV.

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The electron-atomic hydrogen scattering system is an important testing ground for theoretical models and has received a great deal of attention from experimentalists and theoreticians alike over the years. A complete description of the excitation process requires a knowledge of many different parameters, and experimental measurements of these parameters have been performed in various laboratories around the world. As far as total cross section data are concerned it has been noted<sup>1</sup> that the discrepancy between the data of Long et al.<sup>2</sup> and Williams<sup>3,4</sup> for  $n=2$  excitations needs to be resolved in the interests of any further refinement of theory.

We report new measurements of total cross sections and atomic line polarizations for both  $n=2$  and  $n=3$  excitations at energies from threshold to 2000 eV. Following the analysis of Heddle and Gallagher<sup>5</sup> the data will be rendered absolute by normalizing to the Bethe-Born approximation at 2000 eV.

The basic experimental apparatus for the excitation function measurements has been described in an earlier publication<sup>6</sup>. The experimental method consists of cross-firing a magnetically collimated beam of electrons of variable energy with a beam of hydrogen atoms effusing from an RF dissociator. The resonance radiation is wavelength-selected by a vacuum monochromator and a quartz reflector used to determine its linear polarization fraction. The electron beam energy will be ramped from threshold to 2000 eV in time scales  $\sim 10$  minutes, ensuring that any drifting problems which might affect the data are reduced to a minimum. With signal statistics  $\sim 1\%$  and careful attention devoted to the reduction of systematic effects we expect to report absolute values for the cross sections  $Q(2p)$  and  $Q(3p)$ , as well as polarization fractions for the Lyman $\alpha$  and Lyman $\beta$  lines, in the error regime of  $\pm 1.0\%$ .

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